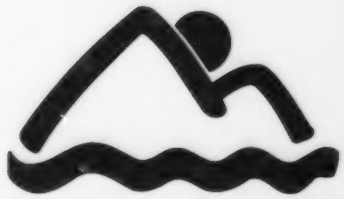
BC Environment

A Strategic Analysis of Waste Gypsum Wallboard Reprocessing in British Columbia



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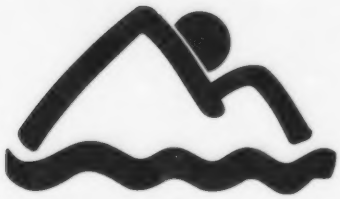

British Columbia
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A Strategic Analysis of Waste Gypsum Wallboard Reprocessing in British Columbia

Municipal Solid and
Biomedical Waste Branch
Environmental Protection Division
B.C. Environment

July 1991

Prepared by:
Peat Marwick Stevenson & Kellogg

Printed on recycled paper

Foreward

The Municipal Solid and Biomedical Waste Branch of the Ministry of Environment is charged with the implementation of the Municipal Solid Waste Management Strategy of the Provincial Government. This Branch coordinates the various efforts of government, the public, industry and business as they work together toward the provincial goal of 50% per capita solid waste reduction by the year 2000.

One initiative undertaken by the Branch in addressing this goal is the commissioning of studies to evaluate existing markets for recyclable materials, and to identify ways to expand recycling activities in the Province.

In February, 1991, Peat Marwick Stevenson & Kellogg was retained to conduct a study of waste gypsum wallboard reprocessing in British Columbia. The study was completed and approved for release in August, 1991. While many stakeholders were involved during the preparation of this report, it is recognized that new information will come to light. All stakeholders are invited to submit their comments and recommendations for improvements to the Manager, Marketing & Enterprise development, Municipal Solid and Biomedical Waste Branch.

R. J. Driedger, P. Eng.
Director, Municipal Solid
and Biomedical Waste Branch

93-00521/

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I

Introduction

A. Background

In late 1989, the Cabinet of the Provincial Government endorsed a Ministry of Environment plan to reduce municipal solid waste (MSW) 50% by the year 2000 in British Columbia. The goal is to be achieved through a combination of source reduction, reuse, and recycling measures. The Municipal Solid and Biomedical Waste Branch of the Ministry of Environment has commissioned a number of studies to evaluate existing markets for recyclable materials and to identify ways to expand reprocessing activities in the province. The Branch has also implemented a variety of programs and incentive schemes recommended in those studies.

Gypsum wallboard waste was banned from Greater Vancouver Regional District (GVRD) landfills in 1984, following concern that its decomposition produced noxious hydrogen sulphide gas. At the time of the ban, ocean dumping became available as a disposal option for gypsum wallboard waste producers. The ocean dumping operation was conducted by New West Gypsum Inc., then known as New Westminster Gypsum Transfer Station Ltd.

Deposits of the mineral gypsum (otherwise called "hydrated calcium sulphate") are created by the natural evaporation of ocean water, which contains high concentrations of calcium sulphate. Returning the gypsum waste to the ocean environment was therefore considered the most environmentally acceptable disposal method available.

However, in 1987, a much more environmentally acceptable solution to the waste wallboard problem was found and New West Gypsum Inc. (New West), a reprocessing business, was established in New Westminster. Today, New West deals with a substantial portion of the wallboard entering the waste stream in the Lower Mainland, although some waste wallboard continues to escape recycling. In February 1991, the Branch retained Peat Marwick Stevenson & Kellogg to conduct a study of waste gypsum board and its reprocessing in British Columbia.

B. Purpose and objectives

The general purpose of the study was to conduct a detailed assessment of the waste gypsum board reprocessing industry in British Columbia. The specific objectives were to:

- Determine the availability of feedstock to existing and proposed gypsum board recycling operations.
- Examine the existing and required infrastructure supporting collection and transportation of the waste material.
- Assess the commercial viability of expanding reprocessing facilities in British Columbia to handle waste gypsum board.
- Recommend options to improve the recovery and recycling of waste gypsum board, and to divert waste gypsum that cannot be economically reprocessed, from landfills.

C. Study methods

Because of the small amount of written material on waste gypsum board reprocessing in British Columbia, we relied primarily on interviews with parties involved, or planning to become involved in the industry. These included: British Columbia's only operating reprocessor, several firms planning to begin reprocessing operations, the two primary end users of reprocessed gypsum, members of the transportation and collection infrastructure, producers of gypsum wallboard waste, industry associations, engineers involved in both disposal of waste gypsum wallboard and use of reprocessed gypsum, and gypsum wallboard reprocessors in other jurisdictions.

II

Highlights

In late 1989, the Cabinet of the Provincial Government endorsed a Ministry of Environment plan to reduce municipal solid waste (MSW) 50% by the year 2000 in British Columbia. The goal is to be achieved through a combination of source reduction, reuse, and recycling measures. The Municipal Solid and Biomedical Waste Branch of the Ministry of Environment has commissioned a number of studies to evaluate existing markets for recyclable materials and to identify ways to expand reprocessing activities in the province. In February 1991, the Branch retained Peat Marwick Stevenson & Kellogg to conduct a study of waste gypsum board and its reprocessing in British Columbia.

Several municipal landfills operated by the Greater Vancouver Regional District (GVRD) experienced serious odour and leachate problems in the early 1980s, caused by the decomposition of industrial quantities of gypsum wallboard waste. A decision was taken by the GVRD in 1984 to ban all gypsum wallboard waste from its landfills. Ocean dumping of the waste was the only alternative disposal method available until November of 1987 when New West Gypsum Inc. (New West) began reprocessing waste wallboard in New Westminster, British Columbia.

There are four primary sources of waste gypsum wallboard: construction sites, wallboard manufacturers, renovation sites and demolition sites. Waste from new building construction is by far the largest contributor of gypsum wallboard to the solid waste stream (64%), while production waste, renovation waste and demolition waste contribute almost equally (12%, 10% and 12% respectively). Together, these sources contribute an estimated 75,000 tonnes of wallboard waste to MSW annually. Fully 74% of gypsum wallboard waste is generated in the Lower Mainland, with 11% generated on Vancouver Island, and the balance attributable to all other areas of British Columbia combined.

About 54% of total wallboard waste generated is recovered and about 43% is reprocessed. Recovery activity is confined to areas where bans are in place or pending (the GVRD and Vancouver Island) and reprocessing activity is confined to the Lower Mainland. In the Lower Mainland, we estimate that about 57% of new construction waste is converted to reprocessed gypsum, 90% of production waste, and 65% of renovation waste. Demolition waste is not suitable to recycling due to heavy contamination.

Recyclable waste gypsum wallboard that is not reprocessed (amounting to about 18,800 tonnes) is improperly disposed (buried on building sites, dumped on roadsides, smashed and left between the walls during new construction and renovation work, cut up and

disposed in garbage bags as household waste, trucked to Indian reservations, crushed and mixed with demolition waste), or it is "stored" by a Lower Mainland firm that states it plans to reprocess the drywall at some future date.

The waste wallboard reprocessing industry functions as follows: waste generated by any of the four sources named above is collected and trucked either to the province's one recycler, New West Gypsum, to a private landfill (in the case of demolition waste), to an improper disposal site, or to the waste wallboard "storage site" referred to above. New West charges $75 per tonne to accept waste wallboard, which it reprocesses, separating the gypsum core of the board from the outer paper covering, producing gypsum that is sold to the province's two wallboard manufacturers, Domtar Inc. and Westroc Industries Ltd. The New West process also produces waste paper which is now ocean dumped but will be recycled once New West builds a planned screening and baling facility.

The gypsum waste wallboard industry is driven by tipping fees. Collectors and haulers must charge sufficient service fees to waste generators to pay disposal costs at New West or Owl Terminals, cover their own costs, and provide a profit. New West also derives 99% of its revenue from tipping fees as reprocessed gypsum sold to the province's wallboard manufacturers brings the company a nominal $1 per tonne. This low price is attributable to the lack of end markets for reprocessed gypsum—New West has virtually no bargaining power when negotiating with Domtar and Westroc. At present, these companies are the only large volume buyers of its product.

New West is the only waste wallboard reprocessor in British Columbia, although several companies plan to enter the market. However, industry growth is limited by a number of factors including: a limited supply of waste wallboard, limited availability of end markets, high transportation costs associated with moving both waste wallboard and recycled gypsum, and recycled content limits on new wallboard. As such, barriers to entry to new competitors are high. While new technology has the potential to open up new end markets (cement manufacturers, mushroom growers) and substantially change British Columbia's waste wallboard reprocessing industry, no technology has yet produced recycled gypsum that satisfies the purity requirements of these potential buyers.

To improve the recovery and reprocessing rates of waste gypsum wallboard in the Lower Mainland and Vancouver Island areas, we recommend a number of policy options including:

- Prohibiting "storing" for recycling.
- Prohibiting the export of waste wallboard to the United States.
- Improving recovery of construction and renovation site waste by requiring proof of proper disposal of wallboard waste.
- Encouraging the stripping of wallboard from buildings slated for demolition.
- Establishing fines for improper dumping.

- Diverting gypsum wallboard waste from private landfills on Vancouver Island.

- Banning gypsum wallboard waste disposal on federal lands.

While recovery of waste gypsum wallboard is relatively well established in the GVRD area and has recently begun on Vancouver Island, all other regions of the province continue to landfill gypsum wallboard waste. Because the establishment of a reprocessing facility outside the Lower Mainland does not appear to be commercially viable, we suggest two policy options: increase tipping fees for gypsum wallboard waste at Interior landfills; and/or provide transportation subsidies.

III

Generation And Recovery Of Waste Gypsum Board

A. Recovery of gypsum began with a ban from some landfills

1. Regulation of landfills in British Columbia

There are three types of landfill in British Columbia: municipal, private and federal. The latter are found only on Indian reservations. Both the provincial Waste Management Act and the Municipal Act play a role in regulating landfills throughout the the province. The Waste Management Act, administered by the Ministry of Environment, regulates waste disposal in all areas of the province and all landfills must be permitted by the Ministry. At the same time, municipalities, under the Municipal Act, have the authority to collect and dispose of municipal waste. Because a municipality generally owns the land on which its landfills are found, municipalities have the right under private property law, to ban certain substances from their landfills.

Private landfill sites, which are regulated directly by the province through the Ministry of Environment, are owned by companies or individuals. The Ministry can restrict substances in these landfills by attaching conditions to the permits it grants to landfill owners and operators. The authority to attach conditions to these permits lies with the Ministry's Regional Waste Managers. Conditions may be attached to permits for a variety of reasons including preventing a pollutant from being introduced into the environment. Substances may only be banned from all landfill sites in the province if a regulation is enacted to amend the Waste Management Act.

In British Columbia, a regulation has not been enacted to ban gypsum from all landfills. Gypsum has, however, been restricted from entering some municipal and private landfill sites at the regional level.[1]

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[1] *Based on discussions with various Ministry of Environment personnel and a lawyer with the Attorney General's office.*

2. Gypsum wallboard waste has been banned from some landfills in British Columbia

Several municipal landfills operated by the Greater Vancouver Regional District (GVRD) experienced serious odour and leachate problems in the early 1980's, caused by the decomposition of industrial quantities of gypsum wallboard waste. Under certain conditions, decomposing gypsum wallboard will emit hydrogen sulphide, a poisonous gas with an odour resembling rotten eggs. Conditions required for hydrogen sulphide production in a landfill include: significant quantities of moisture, the presence of some biodegradable organic matter, and an anaerobic (oxygen-lacking) environment. All three conditions were met in GVRD landfills: the water table is high and rainfall is substantial, gypsum wallboard itself contains 0.5% starch by weight, a biodegradable substance, and the decomposition of the starch creates an anaerobic environment.[2]

After a number of studies were commissioned to examine the odour and leachate problems, a decision was taken by the GVRD in 1984 to ban all gypsum wallboard waste from its landfills. The Capital Regional District (CRD) on Vancouver Island recently followed suit, issuing a ban in principle on wallboard waste in 1990. This ban is expected to be officially enacted in the summer of 1991. The Regional District of Nanaimo has also banned gypsum wallboard waste from its landfills, and the Regional District of Comox-Strathcona plans to do so soon. This will restrict gypsum from entering all municipal landfills of Vancouver Island.

Gypsum wallboard waste continues to be accepted in municipal landfills in all regional districts outside the GVRD/CRD/Nanaimo areas, and district staff report no known problems with production of hydrogen sulphide gas. This may be because landfill conditions differ significantly from those in the coastal region. Specifically, landfills in other areas of the province may have a lower moisture content, and likely contain relatively small quantities of gypsum waste. A site-by-site analysis would be required to determine the likelihood of a hydrogen sulphide gas problem in individual landfills.[3] To the best of our knowledge, no such studies have been conducted outside the Lower Mainland area.

In the Lower Mainland, the ban on gypsum wallboard waste by the GVRD has been supported by the Ministry of Environment, in that private landfills are prohibited from accepting gypsum waste except in incidental remnants from demolition. Private landfills may accept a maximum of 2% gypsum in any given load of

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2 Interview with Head of Waste Management, B.C. Research, Vancouver, March 12, 1991.

3 *Ibid.*

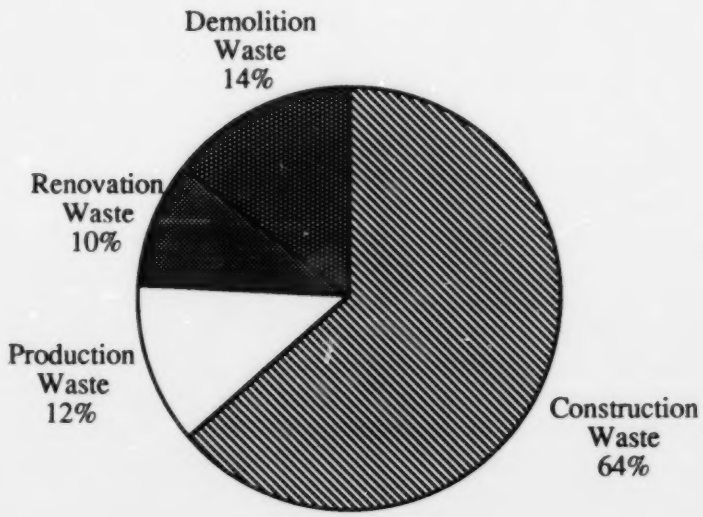
demolition material, and no pre-mixing (adding of powdered gypsum to demolition waste) is permitted.[4]

Similar support from the Ministry of Environment will be required on Vancouver Island if gypsum waste is to be diverted from private landfills once the CRD and Comox-Strathcon bans are in place.

B. Waste gypsum wallboard derived from four primary sources

Construction sites, wallboard manufacturers, renovation sites, and demolition sites all contribute gypsum wallboard to the waste stream, as shown in Exhibit III-1, below.

Exhibit III-1
Sources of waste gypsum wallboard in British Columbia



Waste from new building construction is by far the largest contributor of gypsum wallboard to the solid waste stream. Production waste, renovation waste and demolition waste contribute almost equally. Each waste source is described and quantified below.

1. Construction site waste

Industry participants estimate that 10-12% of new wallboard is wasted during the construction process. Drywall contractors interviewed report that this figure can run as high as 16% in some residential construction, depending on the intricacy of the house design. Another rule of thumb used by both drywall contractors and

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[4] *Interview with Ministry of Environment official, Surrey Regional Office, March 12, 1991.*

gypsum waste haulers puts construction waste at about one pound per square foot of finished floor area of housing, or one tonne for an average new house. A third useful measure examines gypsum waste as a component of total construction waste. A study conducted by the Toronto Home Builders' Society estimates that gypsum wallboard accounts for 15% of total new construction waste, by weight.[5]

We used two methods to estimate gypsum wallboard construction waste in British Columbia. The first is based on an estimate of the number of square feet of new gypsum wallboard sold in the province annually, and the second on estimates of total construction waste.

Industry participants report that about 400 million square feet of gypsum wallboard are sold in the province annually, with a total weight of about 400,000 tonnes. Assuming that 10-12% of this new wallboard is wasted during the construction process, total waste generated can be estimated at 40,000 to 48,000 tonnes.

To corroborate this figure, we examined estimates of total construction waste in the province. A recent report published by the Science Council of British Columbia estimates total construction waste from new residential building at 72,000 tonnes, and from non-residential construction at 168,000 tonnes, for a total of 240,000 tonnes.[6] This yields an estimated 36,000 tonnes of gypsum waste from new construction, using the 15% waste by weight figure noted above. This estimate differs from the lower end of the above estimate by only 10%.

To be conservative in our estimate of waste recovery and reprocessing rates, we have estimated total gypsum wallboard waste from new construction at the highest of the three above estimates, or 48,000 tonnes annually. This figure also best reflects the experience of New West Gypsum.

2. Production waste

There are two drywall manufacturers in British Columbia—Domtar Inc. and Westroc Industries Ltd. Together, these companies control virtually the entire drywall market. They are the only sources of manufacturers' drywall waste in the province and both ship their production waste to New West Gypsum for reprocessing.

New West reports processing about 9,000 tonnes of production waste in 1990.

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5 *Toronto Home Builders' Society, **Making a Molehill out of a Mountain**, (1990), p.5.*

6 *Science Council of British Columbia, Construction Waste Management Report, (January 1991), p. 12.*

3. Renovation site waste

The renovation market also contributes gypsum wallboard to the waste stream. This wallboard, which is stripped by hand from the renovated building, is suitable for recycling. Because renovations vary dramatically in scope, from replacing one wall to virtually rebuilding a structure, and because many renovations are undertaken without proper permits, it is not possible to accurately estimate the total amount of gypsum wallboard that may be entering the waste stream from this source.

New West Gypsum reports receiving about 2,400 tonnes of wallboard sourced from the Lower Mainland renovation market in 1990. This figure includes only the old drywall stripped for the renovation. The waste created when new drywall is installed in the building is included under "construction waste", avoiding double counting.

Based on interviews with several renovation firms, we have made the very rough assumption that 70% of total renovation wallboard waste is recovered for reprocessing at New West in the Lower Mainland. Extrapolating to the province using per capita figures, this method yields an estimate of total renovation waste of about 7,300 tonnes.

4. Demolition waste

Demolition waste contains crushed gypsum wallboard, together with a variety of other construction materials. Because of the high level of contamination of the wallboard and the difficulty of separating it from other wastes, demolition wallboard is not suitable for recycling.

At present, demolition waste is landfilled throughout the province. GVRD landfills do not accept demolition waste, which is disposed in the area's 16 private landfill sites.

We found no statistics describing demolition waste in British Columbia. However, a number of studies describe its composition in other parts of North America. These studies identify concrete as the main component of the waste (67%), followed by brick and clay products (13%), wood products (13%), metals (2%) and "other" (1%).[7] This would indicate that gypsum wallboard accounts for less than 1% of total demolition waste. Given that most buildings slated for demolition were likely constructed before the late 1950's when drywall became a common building material, this figure appears reasonable.

The recent report from the Science Council of British Columbia estimates total waste from residential demolitions at 312,000 tonnes, and from non-residential

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[7] ***Construction Waste Management Report**, p. 17, citing Chatterjee-U.S. Army study.*

demolitions at 768,000 tonnes, for total demolition waste of 1,080,000 tonnes.[8] If we assume that 1% of this waste is gypsum wallboard, then total gypsum wallboard waste entering landfills in the form of demolition waste in British Columbia can be estimated at 10,800 tonnes annually. We caution that this figure could be much lower—gypsum waste may account for much less than 1% of total demolition waste.

C. Over 75,000 tonnes of waste gypsum wallboard are generated annually in British Columbia

Waste generated by the four sources named above combines to produce total gypsum wallboard waste of about 75,147 tonnes annually in British Columbia. Based on information provided by various industry participants, and on per capita estimates, distribution of gypsum wallboard waste in the province may be roughly estimated as shown in Exhibit III-2.

Exhibit III-2
Estimated quantity of waste gypsum wallboard generated in British Columbia (tonnes per year)

Source	Lower Mainland	Vancr. Island	Rest of B.C.	Total
Construction waste[1]	38,400	4,800	4,800	48,000
Production waste[2]	9,060	0	0	9,060
Renovation waste[3]	3,425	1,312	2,550	7,287
Demolition waste[4]	5,080	1,940	3,780	10,800
Total waste (tonnes/year)	55,965	8,052	11,130	75,147

[1]Assumes 80% in Lower Mainland, 10% on Vancouver Island, 10% in the rest of British Columbia, per industry sources.
[2]Per New West Gypsum.
[3] Based on New West experience and interviews with renovators, plus per capita extrapolation to rest of province. (Renovation waste is assumed not to mirror new construction waste in distribution because renovations are less common in the Vancouver area than in the rest of the province due to high land values that encourage demolition.)
[4] Based on Chatterjee-U.S. Army study of demolition waste cited in ***Construction Waste Management Report****, p. 17.*

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[8] ***Construction Waste Management Report****, p. 12. This estimate extrapolates non-residential figures from residential figures, using the same relative proportions of waste generated from the three sources cited.*

Fully 74% of gypsum wallboard waste is generated in the Lower Mainland, 11% on Vancouver Island, with the balance attributable to all other areas of British Columbia combined.

We realize that our estimate of total gypsum wallboard waste generated on Vancouver Island differs substantially from an estimate of 10,000 tonnes entering municipal landfills annually (excluding demolition waste) in the CRD alone, per an analysis of waste at the Hartland landfill completed in 1990. That study was conducted during two five week sessions, one in the spring and one in the fall, when both construction and renovation waste are high. No adjustments for seasonal fluctuations were made. A waste management official employed by the Capital Regional District believes that 5,000 to 10,000 tonnes in the CRD is likely a more accurate estimate.[9]

D. Over half of waste gypsum is recovered in British Columbia

About 54% of waste gypsum wallboard is recovered in British Columbia. In this report, the term "recovery" is used to describe the amount of waste that is diverted from landfill, incineration, or improper dumping activities. We use the term "reprocessed" to describe the gypsum output of the New West plant, given that, technically, recycling occurs only when the reprocessed gypsum is incorporated in a new product.

About 43% of waste gypsum wallboard is reprocessed in British Columbia, with all reprocessing activity confined to the Lower Mainland region. The recovery rate in other areas of the province is zero, although a collection business was established on Vancouver Island on January 1, 1991, in response to the gypsum waste ban by the Regional District of Nanaimo, and in anticipation of the CRD and Comox-Strathcona bans. This new business is described in Chapter V of this report. Recovery and reprocessing rates for waste gypsum wallboard in the Lower Mainland are summarized in Exhibit III-3.

The first column in Exhibit III-3 itemizes total waste generated each year in the Lower Mainland, by waste source. The second column lists total waste recovered, including amounts stockpiled by Owl Terminals (described later in this report), estimated at 5,000 tonnes. This amount is allocated between new construction waste (4,600 tonnes) and renovation waste (400 tonnes), based on the experience of New West Gypsum. The third column provides total reprocessed output from the New West plant, or total gypsum available for recycling. New West reports that reprocessed gypsum weighs about 10% less than the gypsum wallboard recovered from the waste stream due to the separation of paper from the wallboard (7% of total weight), the amount of paper that remains in the

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[9] *Interview with Manager of Waste Management, Capital Regional District, March 12, 1991.*

reprocessed gypsum (about 1% of total weight) and gypsum lost during the process of separating the paper from the gypsum core of the board.

Exhibit III-3
Estimated quantity of waste gypsum wallboard recovered and reprocessed in Lower Mainland

Source	Tonnes of waste generated per year	Total waste recovered per year	Total reprocessed gypsum per year	Percentage of total waste reprocessed per year
Construction waste [1]	38,400	28,740	21,726	57%
Production waste [2]	9,060	9,060	8,154	90
Renovation waste [3]	3,425	2,844	2,220	65
Demolition waste [4]	5,080	0	0	0
Total waste (tonnes/year)	55,965	40,664	32,080	57%

Sources: Total waste generated derived earlier in report. Reprocessing estimates provided by New West Gypsum, March, 1991. Note that total waste recovered figures include estimates of Owl Terminal's total annual volume.

As seen above, New West's total reprocessed gypsum output accounts for 57% of construction waste generated, 90% of production waste generated and 64% of renovation waste generated, for an average reprocessing rate in the Lower Mainland of 57%.

Given a comparable regulatory environment on Vancouver Island (ie. the banning of gypsum from private landfills), recovery rates can be expected to be similar there, once the CRD and Comox-Strathcona bans are in place. However, the temptation to dump gypsum illegally on Vancouver Island will be higher than in the Lower Mainland given the higher tipping fees to dispose of the substance. Because of the cost to transport the waste wallboard to New West, disposal costs on Vancouver Island have been set by the new gypsum collection/transfer station (Island Gypsum Recycle, described in Chapter V) at $120 per tonne. Producers of gypsum waste are now paying municipal tipping fees of $45, although this rate will rise to $65 on July 1, 1991. By contrast, the tipping fee at New West Gypsum is $75 per tonne.

E. Unreprocessed gypsum waste from the Lower Mainland is stockpiled, landfilled or disposed improperly

Based on the above estimates, about 18,805 tonnes of recyclable waste gypsum wallboard (excluding demolition waste) does not reach the Lower Mainland's only reprocessing facility each year. (This amount could be as low as 12,400 tonnes, if total new construction waste is estimated at the lower range of 40,000 tonnes, per page 8 of this report.) Industry participants report that about 5,000 tonnes of this amount is trucked annually to a private landfill in Kamloops, British Columbia, by Owl Terminals of North Vancouver. Owl Terminals charges $85 per tonne for gypsum waste disposal. According to industry sources, the company states that it is storing the gypsum at its Kamloops disposal site for recycling although no efforts to commence recycling operations are evident.

As for the remainder, industry participants report that gypsum wallboard waste is improperly disposed in a number of ways: it is buried on building sites, it is dumped on roadsides, it is smashed and left between the walls during new construction and renovation work, it is cut up and disposed in garbage bags as household waste (following renovation work), it is trucked to Indian Reserves in the Fraser Valley, and it is crushed and mixed with demolition waste.

F. Generation of gypsum wallboard waste is tied closely to activity in the construction market

We have used 1990 figures to estimate quantities of recyclable gypsum wallboard waste generated in British Columbia. The largest contributor to this waste stream is new construction, followed by production waste and renovation waste. Sales of new wallboard (and generation of new construction waste) closely follow activity in both the residential and commercial housing markets. However, industry representatives report that no standard rule of thumb is applied to predict wallboard sales based on new construction starts. A variety of factors are considered when projecting sales, including completion rates of both residential and commercial structures and activity in the home renovation and do-it-yourself markets.

In general, dramatic changes in the supply of waste wallboard are not anticipated in the next three to five years, although a serious recession would have a limiting effect on new wallboard sales.

As is noted in Chapter VI of this report, the demand for recycled gypsum and the availability of waste wallboard tend to balance each other. That is, as new construction activity declines, waste generated declines, and the demand for recycled gypsum by wallboard manufacturers, who are producing less new wallboard, also declines. The converse is also true.

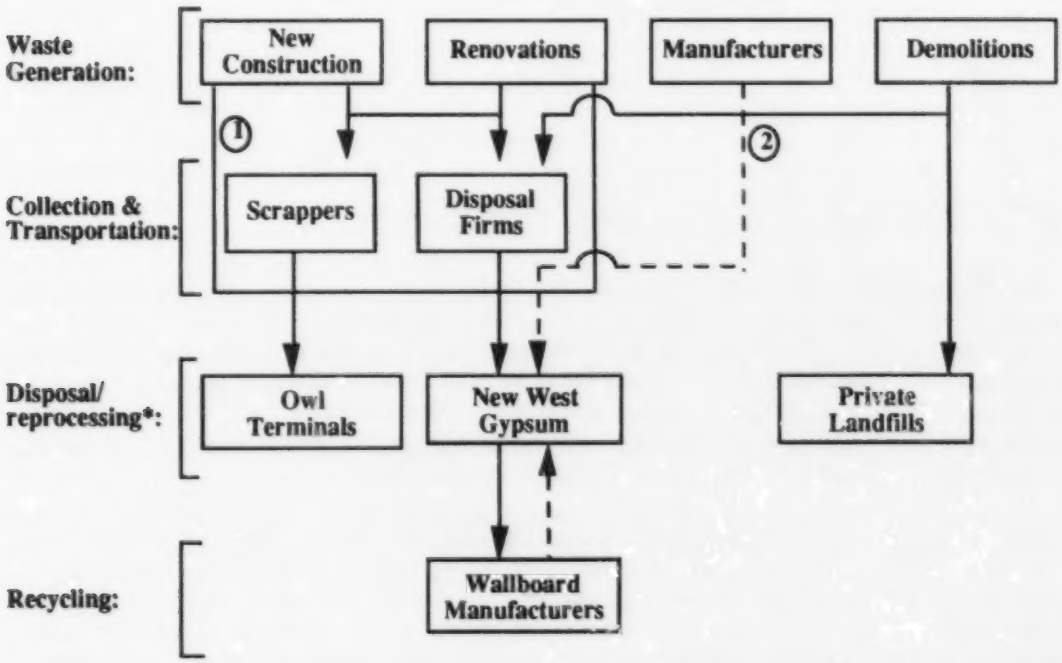
IV

The Gypsum Reprocessing Industry In British Columbia

A. How the gypsum reprocessing industry works

Exhibit IV-1 illustrates the flow of materials through the gypsum reprocessing industry.

Exhibit IV-1
Gypsum reprocessing industry in the Lower Mainland



[1] *Many contractors haul waste wallboard directly to New West.*

[2] *New West handles this trucking; company trucks deliver recycled material to the wallboard manufacturers and backhaul plant waste.*

**Waste from any of the sources, excluding production waste, may be improperly disposed.*

As shown above, waste gypsum wallboard makes its way from the waste source to a disposal site via three main routes: transport by the builder or contractor, transport by "scrappers" who clean and haul waste, and transport via disposal companies that provide disposal bins to construction, renovation and demolition sites, together with waste hauling services. Production waste is transported differently. In this case, New West backhauls the manufacturers' plant waste when it delivers recycled gypsum.

Once it has passed through the collection infrastructure, which is described in detail in Section V of this report, waste gypsum wallboard ends up in one of four places: New West Gypsum for reprocessing, the Kamloops landfill served by Owl Terminals, a private landfill (in the case of demolition waste), or an improper disposal site.

The gypsum waste wallboard industry is driven by tipping fees. Collectors and haulers must charge sufficient service fees to waste generators to pay disposal costs at New West or Owl Terminals, cover their own costs, and provide a profit.

At New West, tipping fees also drive the business. The company derives virtually all of its revenue from this source because the recycled gypsum sold to British Columbia's two wallboard manufacturers brings the company a nominal $1 per tonne. While British Columbia's wallboard manufacturers pay $19 to $29 per tonne for virgin material, the lack of other end markets for recycled gypsum leaves New West with essentially no bargaining power when negotiating with Domtar and Westroc. This situation is described more fully in Chapter VI of this report.

B. There is only one recycler in the market

New West Gypsum Inc. first went into the disposal business in 1986, barging waste gypsum wallboard to a federally-approved ocean-dumping site off Cape Flattery on Vancouver Island. Because barging costs were high and denser loads could be more economically transported, the company President and General Manager set out to develop a process of compacting the waste wallboard. The machine they developed both compacted the wallboard and separated the gypsum from its paper covering, overcoming the problem that had previously been the obstacle to recycling.

New West built a plant in New Westminster, British Columbia and launched its recycling business in November of 1987. At that time, the company expected to process about 15,000 tonnes of waste wallboard annually. Recovery has been much better than expected, and in 1990 New West received about 36,000 tonnes of construction, production and renovation waste for reprocessing, for total output of about 32,000 tonnes of reprocessed gypsum.

According to New West company representatives and their customers, New West's recycling process is not technically complex, but it is effective. At the recycling plant, waste wallboard is hand-cleaned of metal edgings, plastic and other debris, and is then crushed into small pieces with a loader. The pieces are fed into a grinding machine that

separates the outer paper from the gypsum core of the board. A magnet retrieves any nails, screws or other metals that were missed in the initial cleaning.

The gypsum, which has been ground into a coarse powder, is trucked to the province's two drywall manufacturers, Domtar and Westroc, who blend it with virgin gypsum rock to produce new drywall boards. The circle then begins again, with leftover pieces of drywall containing recycled gypsum being trucked back to the New West plant.

As well as recycled gypsum, the New West process creates waste wallboard paper. Until recently, the company was unable to interest recyclers in this paper because of gypsum contamination. It has therefore been dumped at the ocean dumping site off Vancouver Island. The company reports that it has signed a tentative agreement with Paperboard Industries to accept its paper for recycling, provided that it is screened and baled. Paperboard Industries will not pay New West for the paper.

In 1990, New West was able to sell virtually all of its reprocessed gypsum to Domtar and Westroc. One small shipment was made into a minor market. The company is in the process of negotiating contractual agreements with both Domtar and Westroc.

New West is operating very close to capacity. At present, the facility operates 24 hours per day, seven days per week. Company management reports several constraints on operations. First, the processing of wallboard takes place at night and on weekends only. During the six days per week that the public has access to the facility, New West believes it is unsafe to be in operation. Second, storage space for both waste and reprocessed gypsum is limited. The company's ability to run its reprocessing operation at capacity is therefore partially dependent on the end users' ability to accept delivery of reprocessed material. Finally, the machinery in use at the New West plant is not as efficient on a tonnes per hour basis as is possible. With the financial backing of its two chief customers, the company has recently built two new plants: one in Oakville, Ontario, and one in Fife, Washington (near Tacoma). These plants are capable of processing about 50 tonnes of gypsum waste per hour, compared with 12-15 tonnes per hour at the New Westminster facility.

New West is in the process of negotiating to purchase land in Delta, British Columbia where they plan to build a new processing plant, together with a facility to screen and bale waste wallboard paper. Provided that financing can be obtained, New West expects that its new plant will be in operation within six to eight months. At that time, all ocean dumping of waste wallboard paper will cease.

C. Several competitors hope to enter the market

We interviewed three firms that are interested in entering the waste gypsum wallboard reprocessing business. Their current plans and intentions are described briefly below.

1. A potential Lower Mainland competitor

A Lower Mainland entrepreneur has developed a process that separates gypsum wallboard into core gypsum, plus wallboard face paper and back paper that he states is clean enough to be used by paper recyclers. This entrepreneur intends to compete with New West for supply of waste wallboard by undercutting scrappers and disposal companies now in business. He plans a tipping fee of $110 per tonne, a price that would include labour to collect transport and process the waste. As discussed in the next chapter of this report, current tipping fees charged by scrappers approximate $160 per tonne in the Lower Mainland market.

This potential new entrant has approached both Domtar and Westroc with samples of recycled gypsum. He states that both expressed tentative interest but indicated that contractual arrangements with New West exist and that the new firm had only a short time to demonstrate that it could be a reliable supplier. Believing that opportunities to sell to either Domtar or Westroc are limited, the entrepreneur approached James Hardy Gypsum, a Seattle wallboard manufacturer. He states that this company is interested in purchasing the reprocessed material and will pay $10 per tonne, making the $15 per tonne hauling cost to Seattle economic.

2. A potential recycler on the Island has put plans on hold

The second business interviewed is a dry wall and painting firm based in Victoria, British Columbia. This firm, which planned to use waste drywall sourced from Vancouver Island only, has put its plans on hold. Company owners state that they felt unsure about being able to lock down all the waste on the Island, as they believed would be required to run the proposed operation economically. At the same time, the firm's innovative end product ideas required substantial research for which they had been unable to obtain investment funds.

3. An entrepreneur at the concept stage

The third entrepreneur interviewed had very tentative plans to compete with New West in the Lower Mainland area. This individual had only a rough idea of what equipment would be needed to begin reprocessing, had a limited understanding of the marketplace and no clear plans for the sale of the reprocessed gypsum.

D. A number of factors limit industry growth

Three primary factors limit the growth of the gypsum wallboard reprocessing industry in British Columbia:

- **Supply of waste wallboard**

  Without an adequate and steady supply of waste wallboard, a reprocessor cannot operate profitably. Supply of waste is closely tied to the construction market and is not likely to increase dramatically in the future.

- **Availability of end markets**

  Wallboard manufacturers are the primary market for reprocessed gypsum, and there are only two in British Columbia, both located in the Lower Mainland. Some potential secondary markets do exist, but none provides significant opportunities in the near term. New technology could open up substantial secondary market opportunities as discussed in Chapter VI of this report.

- **Transportation economics**

  High transportation costs for gypsum wallboard waste and reprocessed gypsum mean that a reprocessor must locate close to sources of waste supply and end markets. In British Columbia, 80% of supply is found in the Lower Mainland, as is the only large end market.

- **Recycled content limits for new wallboard**

  CSA fire resistance regulations applying to wallboard indirectly place limits on the amount of recycled gypsum that can be incorporated in new wallboard. Because the paper remaining in the recycled gypsum lowers fire resistance in the end product, wallboard manufactures are limited in the amounts that can be used. New reprocessing technology that resulted in purer recycled gypsum would raise this limit and expand end markets. This is discussed further in Chapter VI.

V

The Gypsum Reprocessing Infrastructure

A. Collection of waste gypsum in the Lower Mainland

As shown in Exhibit IV-1, waste gypsum wallboard is transported from construction and renovation the waste sites to the recycler by three primary means:

- Contractors collect and haul their own waste.
- "Scrappers" clean the site and haul the waste.
- Disposal companies provide bins that are filled by the contractor and hauled by the disposal company.

In the case of renovation waste, the general public also participates in the collection process, delivering waste wallboard to the recycler.

1. Contractors

Industry participants report that a large number of building and drywall contractors collect and haul their own drywall waste to New West or Owl Terminals. Contractors working on small jobs are especially likely to use this collection method.

2. Scrappers

"Scrappers" are hired by contractors to clean up job sites, usually daily, and to haul away waste wallboard. Most scrappers are one person companies operating one truck.

Scrappers in the Lower Mainland generally charge about $160/tonne to collect and dispose drywall waste. This figure includes the $75/tonne tipping fee at New West. Prices vary depending on factors like the number of buildings the scrapper is cleaning for one contractor, the type of building, and the location of buildings.[10]

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[10] *Interviews with Lower Mainland scrappers and drywall contractors.*

3. Waste disposal companies

Waste disposal companies place bins at construction and renovation sites for collection of waste wallboard. The labourers on the job site load the bins, which are hauled away for disposal when full.

Construction sites are usually equipped with 30 yard bins that hold four or five tonnes of waste gypsum, depending on how the bin is packed and whether the wallboard is wet. Bins are priced at about $130, plus $72 for disposal of gypsum, resulting in a per tonne charge of $40 to $50. To this, the contractor must add the price of his labourers' time to fill the bin.[11]

B. Some waste gypsum wallboard is stockpiled

In the Lower Mainland, waste drywall reprocessing efforts are hampered by a firm called Owl Terminals, located in North Vancouver. This firm accepts drywall waste from contractors, scrappers, disposal companies and the general public, for a tipping fee of $85 per tonne.

Owl Terminals then trucks the waste to a landfill site in Kamloops, British Columbia. According to industry participants, Owl Terminals representatives state that the company is storing this waste for recycling. However, no efforts to commence recycling have been made.

Industry participants estimate that Owl Terminals has accumulated of about 8,000 tonnes of drywall over the past 18 months.

C. A collection/transfer station has been established on Vancouver Island

On January 1, 1991, Island Gypsum Recycle began operations in Sidney, British Columbia. A collection/transfer station for waste gypsum wallboard on Vancouver Island, the business was established in response to the ban on gypsum wallboard waste in the Nanaimo area. It was also established in anticipation of the official ban on gypsum waste by the Capital Regional District and the Comox-Strathcona Regional District.

Island Gypsum Recycle receives waste from contractors, scrappers, disposal companies and the general public for a tipping fee of $120 per tonne. The company palletizes the waste wallboard and ships it to New West for processing. Island Gypsum Recycle pays New West $75 per tonne to accept the waste, leaving $45 per tonne to cover transportation and other costs.

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[11] *Interviews with Lower Mainland disposal companies and drywall contractors.*

D. The collection business developed in response to bans, not municipal tipping fees

If a ban on drywall waste from landfills is in place, waste producers have two choices—pay the fees required to transport and dispose of waste at a reprocessing facility, or dispose of scrap drywall improperly. If a ban is not in place (as in the Metro Toronto market, where gypsum is reprocessed but not banned), reprocessors find that their fees must be set marginally under landfill tipping fees, and that convenient collection stations must be set up to attract business. In the Metro Toronto region, where tipping fees are about $150 per tonne, the reprocessor can operate profitably with no ban in place.

The same is not true in most areas of British Columbia. Tipping fees outside the Lower Mainland are very low. For example, Kelowna municipal landfill tipping fees are $16 per tonne. The cost to transport palletized waste gypsum to Vancouver for processing is about $20 per tonne, plus $75 for disposal at New West, plus a collection cost, for a total in excess of $100 per tonne, more than five times current amounts.

Given current municipal tipping fees in the province, an infrastructure to collect waste gypsum wallboard outside those areas where bans are now in place will not develop unless gypsum wallboard waste is banned from all landfills, or tipping fees are raised to a level that makes waste collection and transportation to a reprocessor economic.

VI

Markets For Reprocessed Gypsum

A. Wallboard manufacturers are the major market for reprocessed gypsum

Wallboard manufacturers are the primary market for reprocessed gypsum. In British Columbia this market comprises two firms only—Domtar and Westroc. In 1990, Domtar purchased about 26,000 tonnes of reprocessed gypsum from New West, while Westroc purchased 5,700 tonnes, accounting for about 99% of New West's production.

The percentage of reprocessed gypsum that can be mixed with virgin rock during the drywall manufacturing process is limited by two factors: Canadian Standards Association fire resistance regulations and an individual manufacturers' production process.

CSA regulations require that new wallboard be subjected to fire resistance tests before receiving approval for sale. The paper content of the board affects its performance on these tests. Therefore, it is key that the recycling process be successful in separating the outer wallboard paper from the gypsum core of the board. While New West states that its recycled gypsum contains less than 1% paper, and that it is allowed a maximum of 2%, the amount of recycled product that can be incorporated in new board by manufacturers is constrained by this regulation.

Production processes vary from one company to another, affecting tolerance levels for reprocessed gypsum. Domtar reports that it has set a limit of 20% reprocessed gypsum content in its drywall, and that its 26,000 tonne purchase from New West last year came very close to this limit. Westroc has established a 15% limit, which it has just begun to work to achieve.

Given the price differential between virgin and recycled gypsum, there is a strong incentive for both provincial drywall manufacturers to maximize their products' recycled content. In today's market, Domtar and Westroc pay $19 and $29 per tonne respectively for virgin gypsum, compared with the $1 per tonne paid to New West for the reprocessed

material.[12] Both companies report that they will continue to work to increase the proportion of reprocessed gypsum that can be incorporated in their wallboard.

B. Some potential secondary markets for reprocessed gypsum exist

Three potential markets for reprocessed gypsum exist: the British Columbia Mushroom Growers' Association, fertilizer manufacturers and cement manufacturers.

- The British Columbia Mushroom Growers' Association purchases about 1,750 tonnes of virgin gypsum annually. At present, Domtar supplies all of this organization's gypsum needs. According to a manager with the Association, the co-operative is reluctant to consider substituting recycled gypsum for the virgin material. This individual believes that the risks associated with using recycled gypsum outweigh potential cost benefits. While he stated that using recycled gypsum is not "impossible", a recycler would have to prove that "absolutely no risk" would be attached to the decision.

- New West sold about 260 tonnes of reprocessed gypsum to a fertilizer company in 1990. The reprocessed gypsum was used to make a fertilizer intended for soil with a specific ph level. New West believes that this market is very small, amounting to no more than a couple of thousand tonnes annually.

- Cement manufacturers use virgin gypsum in the manufacturing process. However, because their purity requirements are stringent, this a difficult sale for reprocessors. According to a potential market entrant, is the gypsum in wallboard contains certain chemical additives designed to form air pockets in the gypsum core of the board and reduce the weight of the final product. These additives must be thoroughly cleansed from the recycled gypsum before it could be used by a cement manufacturer. While chemical foaming agents are available that perform this function, this potential recycler has yet to satisfy the quality control requirements of the local cement industry.

  Discussions with representatives of the local cement industry confirmed the difficulty of this sale. An official with the largest local producer stated that while the use of recycled gypsum might be "possible", he did not believe it to be "probable". This is primarily because of the liability issues associated with substandard cement.

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[12] *According to an official with one of the drywall manufacturers, the price difference for virgin material paid by the two firms is due primarily to differences in transportation costs (barge versus rail) and differing internal accounting procedures.*

At the same time, this market is large, with British Columbia cement manufacturers using about 100,000 tonnes of virgin gypsum annually. If a technology were developed that produced recycled gypsum suitable for use by cement manufacturers, the gypsum reprocessing industry in the Lower Mainland would change dramatically.

C. New technology could mean new markets

The development of a technology capable of producing recycled gypsum pure enough to be used by the cement industry could dramatically change the gypsum reprocessing industry. A very large new market would be created, forcing up the value of recycled gypsum.

However, based on our discussions with various industry participants, several years of testing by the cement industry would be involved before a decision would be taken to purchase recycled gypsum, and at this time, the probability that this market will develop seems low.

New technology resulting in purer recycled gypsum could also expand the market by increasing the levels of recycled content in new wallboard. While the province's wallboard manufacturers would be interested in higher quality reprocessed gypsum, contractual agreements with New West described in the next Chapter of this report would probably limit the impact of a new entrant with superior technology for several years.

D. Supply and potential end markets are virtually balanced at 90% recovery of waste wallboard in two areas of B.C.

If 100% of gypsum wallboard waste was recovered from the Lower Mainland and Vancouver Island, a reprocessor would receive about 57,000 tonnes of waste annually. (This figure does not include demolition waste.) Assuming 10% attrition during reprocessing, this would create a supply of reprocessed gypsum of about 51,300 tonnes.

Domtar is close to its 20% reprocessed content limit at a purchase of 26,000 tonnes, while Westroc will reach 15% at 17,000 tonnes, resulting in total potential annual purchases by wallboard manufacturers of 43,000 tonnes. This creates an annual surplus of 8,300 tonnes.

Secondary markets could absorb at least part of this surplus. It would also be improved if either Domtar or Westroc succeeds in increasing its reprocessed content in the future.

At 90% recovery, the market is virtually balanced, without considering secondary markets.

E. Supply and demand fluctuate with new building starts

In today's Lower Mainland market, the forces of supply and demand are well balanced. Because new construction waste and manufacturers' waste are the two primary sources of waste gypsum, an upturn in the construction market would increase the supply of waste available for recycling. Simultaneously, the total raw material requirements of the Lower Mainland's two wallboard manufacturers' would increase. By the same token, a downturn in the construction industry would reduce both supply of and demand for recycled product.

This balance could be upset if wallboard manufacturers from outside the Lower Mainland gained a significant foothold in the market. During a construction industry upturn, the supply of gypsum waste could grow significantly more quickly than the raw material needs of local manufacturers. At present, at least two U.S. wallboard manufacturers (James Hardy Gypsum, from Washington state and Republic Gypsum, from Texas) are attempting to gain a foothold in the British Columbia marketplace.

F. Distant markets are uneconomic

Recycled gypsum is a heavy and expensive commodity to transport. Given current tipping fees and the nominal amount paid by end users for reprocessed gypsum, sales to distant markets are uneconomic. While one potential market entrant states that a Seattle manufacturer will pay up to $10 per tonne for recycled gypsum, New West Gypsum's new Fife, Washington plant would be a more logical supplier for this buyer.

At present, British Columbia waste wallboard reprocessors' end market opportunities appear to be limited to the Lower Mainland.

VII

Outlook For The Future

A. An expansion of New West Gypsum is likely

New West Gypsum is operating at close to capacity. Its current facility, built with a total throughput expectation of 15,000 tonnes annually, now operates 24 hours per day, seven days per week, processing close to 36,000 tonnes of waste gypsum wallboard.

New West is in the process of negotiating to purchase a tract of land in Delta, British Columbia where it intends to build a new, more efficient processing plant. Its machinery will be capable of processing more than three times as much waste gypsum per hour as is now handled at the New Westminster facility. Unlike the company's current facility, the new plant will be designed such that processing can take place during regular business hours, while the public has access to an adjacent receiving yard. Finally, the plant will include a paper screening and baling facility capable of handling wallboard waste paper. This will allow the company to supply Paper Board Industries with its paper waste, and to cease related ocean dumping activities.

New West management reports that securing financing is the only barrier to commencing building of its new plant. Given that the company has been successful in obtaining investment to build a plant in Fife, Washington ($1.2 million financed by Domtar) and another in Oakville, Ontario ($2.5 million financed by Westroc) it seems likely that the Lower Mainland expansion will take place.

B. Barriers to entry are high

The supply of waste gypsum wallboard, the availability of end markets and the transportation economics of the gypsum reprocessing industry all place constraints on growth potential. Those attempting to compete in the Lower Mainland will go head to head with New West in a battle for both raw materials and end markets. Added to this tough competition are transportation costs that constrain looking far outside the Lower Mainland either for raw materials or for end markets.

A new entrant could compete with New West for supply on the basis of price or convenience. Both are important to the waste producer. One potential competitor plans to undercut waste collectors and haulers now in business, to capture waste directly at the

source. This strategy could work, provided that the new reprocessor has the resources to withstand a potential price war. Another potential competitor plans to capture waste from New West by offering convenient drop-off stations for waste gypsum. This strategy could also be successful in procuring some waste, and largely accounts for Owl Terminal's current share of the waste stream. (Owl Terminals is located in North Vancouver and receives most of its waste from that area.)

However, assuming that a competitor can secure a steady and sufficient supply of waste wallboard, the problem of end markets remains. New West has a strong relationship with both primary end users in the Lower Mainland. This relationship has been contractually sealed with one of these companies in the past, and the contract is in the process of being renewed. The other player has just begun to use recycled product and no contractual arrangement has existed to date. However, the companies are in the process of negotiating an agreement. At least one of the drywall manufacturers is likely to commit to minimum annual purchases, effectively locking a competitor out of at least the bulk of its purchases. Both drywall manufacturers report that their contracts with New West are likely to extend for a term of three to five years.

Finally, the high costs of transporting waste gypsum wallboard and reprocessed gypsum make distant waste supplies and end markets uneconomic. While it is possible that U.S. wallboard producers will pay more than $1 per tonne for recycled gypsum making transportation costs bearable, the Fife, Washington facility built by New West will have ready access to the closest U.S. markets.

C. Reprocessing waste gypsum wallboard outside the Lower Mainland lowers some of the barriers to entry but is likely not economic

While barriers to entry are high for a potential reprocessor of gypsum wallboard waste in the Lower Mainland area, locating outside the Lower Mainland would help reduce the risk faced by a new entrant to the industry. Vancouver Island and the Interior of British Columbia are possible locations.

1. Vancouver Island

On Vancouver Island, a new entrant would have ready access to waste supplies and could compete with the existing transfer station on the basis of tipping fees. However, the supply of recyclable waste is small (estimated at about 6,000 tonnes) and may be insufficient to drive a profitable reprocessing business, as discussed in Section D of this chapter.

In addition, a reprocessor would still be faced with the problem of competing with New West for Lower Mainland end markets, and with transportation costs associated with shipping the reprocessed gypsum to the end market. Unless a new,

more profitable market than Domtar and Westroc were available, this factor alone would likely make a reprocessing business unprofitable.

2. The Interior

In the Interior of British Columbia, a reprocessor would also have ready access to supply, without competition from New West . Wallboard manufacturers in Alberta are a potential end market.

We have estimated supply of recyclable wallboard waste outside the Lower Mainland and Vancouver Island areas at about 7,350 tonnes annually. No collection infrastructure now exists, and as discussed in Chapter V of this report, an infrastructure will not develop unless waste wallboard is banned from Interior landfills, or landfill tipping fees for gypsum waste are raised dramatically.

The market for new wallboard in Alberta is similar to the market in British Columbia, with Domtar (in Edmonton) and Westroc (in Calgary) controlling the vast majority of sales. Domtar states that it has "no interest" in purchasing recycled gypsum from a British Columbia-based reprocessor. The company plans to set up its own in-plant recycling facility to recycle production waste and also states that it has access to about 100,000 tonnes of waste that has been stockpiled on the Domtar property for several years. Once that stockpile is depleted, the company plans to backhaul new construction waste after making deliveries of wallboard to contractors.

Westroc, on the other hand, would be interested in an Eastern British Columbia source of recycled gypsum "if the landed price was right". A company official with the Calgary office states that Westroc in Alberta sells comparable volumes to Westroc in British Columbia and could therefore potentially use as much as 17,000 tonnes of recycled gypsum annually. He was unable to state the amount that Westroc would consider paying for the recycled product.

According to a local transportation firm, transport costs for shipping palletized recycled gypsum from an Eastern British Columbia location (say Revelstoke) to Calgary, would approximate $23 per tonne. Given the magnitude of this cost, it appears unlikely that a reprocessor in the Interior would be able to offer recycled gypsum to Westroc in Calgary at a price sufficiently below virgin gypsum to make the purchase attractive to the wallboard manufacturer.

D. Assessing the potential viability of new competitors means assessing supply, end markets, and the business itself

Potential new competitors in the British Columbia market seeking to establish a commercially viable reprocessing operation should be able to demonstrate to prospective investors that:

- An adequate supply of waste exists, and that a collection infrastructure can be developed if necessary.
- End markets are available and committed.
- Planned production processes can be operated economically given tipping fees and end product pricing.

1. Adequate waste supplies

Interviews with waste wallboard reprocessors operating in the Ontario marketplace, and with New West Gypsum in British Columbia, provided widely varying estimates of the amount of waste wallboard that is needed to economically run a reprocessing operation. These estimates ranged from 5,000 tonnes annually to "at least 20 to 30,000 tonnes", in the Ontario marketplace, with New West falling between the two estimates.

The amount of material needed to run a plant profitably is dependent on the equipment and production processes used by the individual plant. Potential competitors should be able to demonstrate to investors that adequate waste to run their specific process is available.

2. End markets

End markets for recycled gypsum are not plentiful. Potential new entrants must be able to demonstrate that purchasers for their product exist, and are very likely to buy once a plant is in production. In British Columbia at present, viable end markets appear to comprise two companies only. Both companies' needs are met by the existing reprocessor. While new entrants with a better product may succeed in selling to these companies, large volume sales may well be ruled out for three to five years by contracts in place between these firms and New West. If new entrants plan to rely on opening up new markets, then they should be able to demonstrate the acceptability of recycled gypsum to these buyers.

3. Financial viability of individual commercial enterprises

None of the waste wallboard reprocessors interviewed would supply cost information. However, all stated that reprocessors must be paid to accept wallboard waste. Although one Ontario reprocessor interviewed sells strictly to secondary

markets (kitty litter and fertilizer), tipping fees remain the primary source of revenue.[13]

Reprocessors reported that primary operating costs include material handling and labour. Ontario reprocessors also stated that a plant must be located within two hours trucking distance of end markets. This distance would be shorter in British Columbia where trucking costs are higher.

E. The gypsum wallboard content of demolition waste is likely to grow

We estimate that gypsum wallboard waste comprises about 1% of total demolition waste in British Columbia. However, this proportion is likely to grow as more buildings constructed during the past three decades are demolished. The majority of these structures likely contain gypsum wallboard. Diverting this waste from landfill will therefore become increasingly important and may expand reprocessing opportunities.

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[13] *To the best of our knowledge, there are no kitty litter manufacturers in British Columbia that use gypsum as an input to the production process.*

VIII

Recommendations To Improve Rates Of Waste Gypsum Wallboard Reprocessing

A. Amended and new regulations could improve recovery

An estimated 23,885 tonnes of gypsum wallboard waste escapes reprocessing in the Lower Mainland annually, inclusive of demolition waste. Recovery in the rest of the province is nil, although Vancouver Island has now begun to divert gypsum from the municipal waste stream. A number of regulations could improve reprocessing rates.

1. Restrict landfilling outside the Lower Mainland

A substantial quantity of gypsum wallboard waste that could be reprocessed is trucked to a landfill in Kamloops annually. By stating that the gypsum is being stored for recycling, the owner of the landfill circumvents restrictions applying to landfilling the waste.

It is our understanding that a regulation is now being drafted that will address this situation. The regulation will establish a 500 tonne limit on the amount of waste gypsum wallboard that may be "stored" at any one site.

While this regulation may stop Owl Terminals from continuing to stockpile waste gypsum wallboard and should prevent similar situations from arising in the future, it will not prevent gypsum from moving over the border to landfill sites in the United States. To ensure improved recovery, a regulation should be put in place that prevents waste gypsum wallboard waste from being transported into the United States.

It is also possible that creative entrepreneurs will find it economic to purchase several sites for gypsum storage, each with less than 500 tonne capacity. Depending on the relationship between tipping fees, transportation costs and land costs, it might be economic to purchase a number of small "storage" sites.

2. Improve recovery of construction site waste

About 57% of gypsum wallboard construction site waste is converted to reprocessed gypsum in the Lower Mainland annually. While the regulation

described above should improve this figure, some waste will undoubtedly continue to escape reprocessing.

New construction work is inspected regularly by building inspectors. Building and drywall contractors are required to provide proof of compliance with a wide range of regulations. We recommend that the Ministry of Environment work with appropriate municipal officials to ensure that proof of proper disposal of gypsum wallboard waste be added to this list. Receipts provided by New West Gypsum could be returned to the building contractor by waste haulers, for provision to building inspection authorities. Those contractors hauling their own waste would simply provide the receipt received by their own drivers.

3. Improve recovery of renovation site waste

While many renovations are undertaken without proper permits, those that are permitted are monitored by building inspectors. Proper disposal of waste wallboard from these sites could be regulated as described above.

4. Improve recovery from demolition sites

Demolition permits are issued by municipalities. These permits require that demolition plans specify how wastes contaminated with hazardous substances such as asbestos and PCB's will be disposed. However, no requirements exist for the handling of non-hazardous materials.

The Ministry of Environment could work with municipalities to encourage the recovery of gypsum wallboard from demolition sites. The wallboard could be stripped prior to demolition, as a condition of the permit.

5. Establish fines for improper dumping

A system of fines should be established to discourage improper dumping activities. If the regulations described above are put in place, those participating in improper dumping should be easily identified. The fines should substantially exceed tipping fees for proper disposal.

6. Divert gypsum from private landfills on Vancouver Island

The Ministry of Environment should ensure that its regional managers amend permits to private landfill sites on Vancouver Island, to ensure that waste gypsum wallboard is not diverted from the Island's new collection/transfer station.

7. Ban gypsum wallboard waste disposal on federal lands

Industry participants report that some gypsum wallboard waste is trucked to landfills on Indian Reserves in the Fraser Valley. The provincial Ministry of

Environment should work with appropriate federal authorities to ensure that this practice is ended.

B. How could the government promote waste gypsum processing outside the Lower Mainland

It appears that a reprocessing facility outside the Lower Mainland would likely be uneconomic given limited waste supply, limited end markets and the high cost of transporting recycled gypsum to end markets. Policy options to encourage reprocessing of waste gypsum wallboard outside the Lower Mainland might include:

1. Increase tipping fees for gypsum wallboard waste at Interior landfills

An increase in tipping fees for gypsum wallboard waste at landfills in the Interior could make it economic to haul the waste to the Lower Mainland for reprocessing. The Ministry of Environment would be required to work with local municipalities and regional districts to establish and enforce this system.

Based on estimates contained in this report, we caution that recovering Interior waste for reprocessing in the Lower Mainland could flood Lower Mainland end markets. We also caution that those municipal managers we spoke with outside the Lower Mainland area believe that gypsum wallboard waste makes up a very small percentage of total municipal waste and may be reluctant to impose higher tipping fees on local building contractors and waste haulers.

2. Provide transportation subsidies

Transportation subsidies would also make hauling gypsum wallboard waste economic. However, subsidies must be administered on an individual case basis and are therefore expensive to establish and monitor.